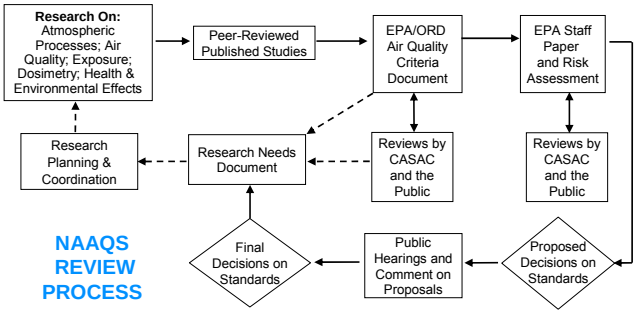
SCIENTIFIC BASES FOR THE DEVELOPMENT OF THE NAAQS FOR LEAD

Author(s): L. Grant, J. Brown, B. Hemming, J.Y. Kim, D. Kotchmar, T. Lewis, A. Mudipalli, S. Nadadur, D. Svendsgaard, L. White

Affiliation(s): U.S. EPA/Office of Research and Development (ORD)/National Center for Environmental Assessment (NCEA)/Environmental Media Assessment Group/Research Triangle Park (RTP), NC

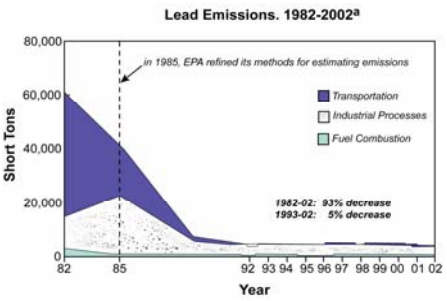
NAAQS REVIEW PROCESS



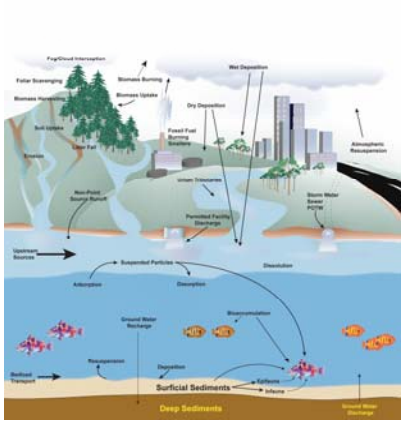
LEAD CHRONOLOGY AND REVIEW TIMELINE

1978	Dec 2005	Mar 2006	May 2006	Jun 2006	Oct 2006	May 2008	Sept 2008
Standard Set ≤ 1.5 μg/m³ quarterly	1st External Review Draft	CASAC Review	2nd External Review Draft	CASAC Review	Final Pb AQCD	Proposed Decision	Final Decision

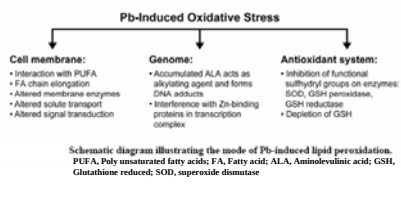
CHEMISTRY/SOURCES

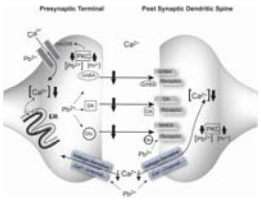


ENVIRONMENTAL EFFECTS

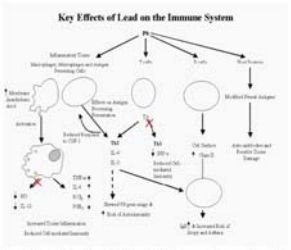


HEALTH EFFECTS

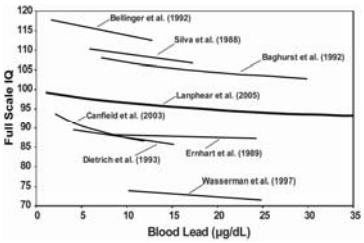




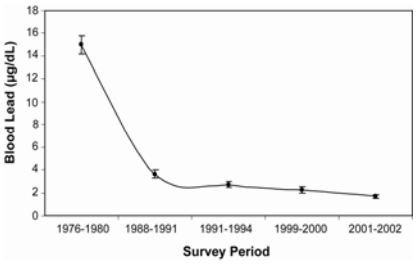
Effects of lead on neurotransmission



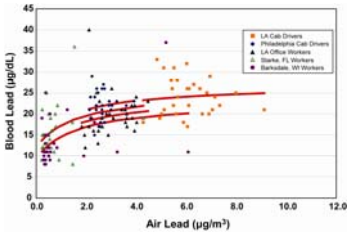
This figure shows the fundamental alterations to the immune system and to immunological response and recognition induced by exposure to lead. The functional shift: are disproportionate compared to the relatively modest changes among leukocytes with low to moderate exposure to lead.



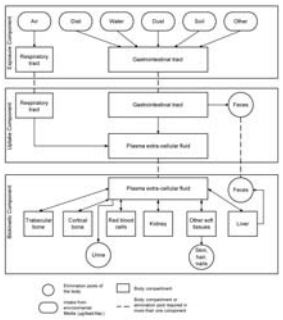
Concentration-response relationships of IQ to blood lead for the individual studies and the pooled analysis by Lanphear et al. (2005).



Nationwide trends for pediatric blood lead levels in U.S. children (1 – 5 yrs old) based on NHANES results.



Relationship of blood lead to personal air lead concentrations in five occupational cohorts. This relationship was used in a risk assessment of the impact of air lead on cardiovascular disease. Mathematical models are being validated to replace the need for relying on these empirical relationships. (Azar et al., 1975)



Structure of EPA's integrated exposure uptake biokinetics model for Pb in children ≤ 6yr old

SUMMARY AND CONCLUSIONS

- Lead is a multimedia pollutant with exposures occurring through air, drinking water, food, dust, and lead-based paint in older housing.
- In the US, lead was phased out of gasoline in 1975 through 1990, resulting in a >95% decline in ambient concentrations and consequent declines in blood lead levels.
- Lead affects a broad array of organ systems including the nervous, renal, cardiovascular, immune, and reproductive systems. Heme synthesis and bones and teeth are also affected, with no apparent threshold.
- Recent animal toxicology studies describe mechanisms, such as oxidative stress and mobilization of lead from bone, which underlie the pathopysiology of lead.
- Effects on IQ in children and blood pressure in adults are found at blood lead levels < 10 μg/dL, the current CDC level of concern.
- Most terrestrial ecosystems in North America remain sinks for lead. Lead released from forest floor soils in the past has been largely immobilized in mineral soils, with export out of the terrestrial ecosystem being quite low.
- Lead can bioaccumulate in the tissues of aquatic organisms through ingestion of food and water, and adsorption from water, and can subsequently lead to adverse effects if exposed to sufficiently high concentrations.

The views expressed in this poster are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.